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Editorial

PROCESSED FOODS – ARE THEY SAFE?

Processed foods contain food particles at different forms added with different additives. Apart from the effects of food items with high calories which may have very strong relation with obesity, diabetes, high blood lipids, high blood pressure etc., processed foods may have many other effects. The present article deals with the food additives of the processed foods.

Food additives

Food additive means any substance not normally consumed as a food by itself and not normally used as a typical ingredient of the food, whether or not it has nutritive value, the intentional addition of which to food for a technological (including organoleptic) purpose in the manufacture, processing, preparation, treatment, packing, packaging, transport or holding of such food results, or may reasonably expected to result, (directly or indirectly) in it or its by-products becoming a component of or otherwise affecting the characteristics of such foods (Codex 2013).

As per WHO (2017), substances that are added to food to maintain or improve the safety, freshness, taste, texture, or appearance of food are known as food additives.

So, all the items added with the nature given food or food particles may be regarded as food additives.

Recommendation of FDA

In the globe, United States Food and Drug Administration (FDA) is perhaps the strongest influential body for giving permission to any food additive to be mixed with any food item. As per the literature of FDA, "when evaluating the safety of a substance and whether it should be approved, FDA considers: 1) the composition and properties of the substance, 2) the amount that would typically be consumed, 3) immediate and long-term health effects, and 4) various safety factors''.

As per the statements published by FDA and International Food Information Council (IFIC) Foundation, different food additives along with color materials used with food with particular purpose are shown in Table 1.

FDA also recommended the permitted food additives with the comment as "food ingredients have been used for many years to preserve, flavor, blend, thicken and color foods, and have played an important role in reducing serious nutritional deficiencies among consumers. These ingredients also help ensure the availability of flavorful, nutritious, safe, convenient, colorful and affordable foods that meet consumer expectations year-round.... all additives are subject to ongoing safety review as scientific understanding and methods of testing continue to improve. Consumers should feel safe about the foods they eat".

The certificate of FDA is considered a base of idea for addition of food additives in many other countries. But many questions can be raised against such practice.

The other look

Expression of toxicity and adverse reactions

It was found many times in the history of drug development that many strongly effective molecules were identified as toxic to the people following use among patients for years. Many important drugs (medicines) can react with other drugs inside the body of the treated persons and may cause many serious health problems. When common people take such drugs with or without the advice of the physicians, ultimately suffer for their toxicity or adverse drug reactions. In many cases, such after effects are felt by the consumers after a long time. So, without having any scope to know the actual reasons, they have no other way than to consider these detrimental health effects as 'ill fate'.

The old episode of use of Thalidomide in pregnant mothers on 1957 and the recent episode of use of Nimesulide among children up to 2010 can be remembered as some examples.

How the food additives work inside the body system? It follows almost the same pathway of detoxification and excretion like those of drugs after absorption from the intestine. The difference is that people do not take medicines regularly, but many of them regularly take a huge number of such additives!

Excretion of a certain percentage of almost all introduced drugs (orally fed or injected) from the living body are not identified. Perhaps a portion of them remain inside the body at different tissue level. Same may happen for the introduced chemical additives of processed food and food products.

Relating to it, many works for determination of toxic effects of food additives by standard laboratory methods were performed and reported (Al-Shammari *et al.* 2014, Thomas and Adegoke 2015, Sales *et al.* 2017).



Fig. 1.The 'Edible oil' carried to the fast food stalls and road side restaurants in Kolkata, India.

Long term toxicity study

Though it is a common claim of the concerned authorities of performing study for short term and long term effects of the food additives before considering them safe, the actual long term effect study on human health is practically impossible by the present analytical systems and techniques. A modern day man does not consume only one type of food or beverage daily. In a lifespan average of 70 years, he or she took food and drinks of enormous types. So, numerous types of food additives enter in their body on regular basis. How the effect of those food additives can be evaluated by any animal or *in vitro* model?

In the FDA statements, this limitation is also touched. "Because of inherent limitations of science, FDA can never be absolutely certain of the absence of any risk from the use of any substance. Therefore, FDA must determine - based on the best science available, if there is a reasonable certainty of no harm to consumers when an additive is used as proposed".

Re-evaluation of FDA recommendations by the scientific communities

The recommendations of FDA are not outside the re-evaluation of the scientists. Some limitations of the FDA recommendations are shown in Table 2, where the author listed fifty toxic food ingredients and artificial additives which should be avoided for their potential toxicity. As per the author, "while FDA generally recognizes most additives on this list as 'safe,' there are growing concerns about the safety of many common food additives, if consumed in large quantities" (MPH Programs List).

The 'Natural' additives

Many additives are mixed with food as 'natural' without disclosing the name and state of use of such additives perhaps just to attract consumers, but their claim may not be true in most of the cases. As for example - some flavoring food additives are claimed as 'natural', but as per the definition, the 'natural' flavoring agents include nut, fruit and spice blends, as well as those derived from vegetables and wine (WHO 2017). So it can be said that in many cases, nature identical synthetic chemicals or some extracted derivative of a natural agent is added with the food in the name of 'natural'.

The Indian condition

In India, the control over mixing of additives in different food items during preparation of processed foods is not above the level of questioning. Practically, anybody can mix any types and numbers of additives and adulterants during preparation of food or food item at local level. Most of the consumers search only the cheapest food, food items and food products without considering their quality, food value or danger of the mixed adulterants and additives. In many cases, the prepared processed food is sold at a far lower cost than the total cost of the items used to prepare it!

The quality of famous dairy item of vegetarians of India – *Paneer* (cheese) – sold elsewhere in Indian market are never checked. It is sold at Rs. 100 per kilogram in wholesale market which is lower than the cost of even three liters of milk! The famous non vegetarian item – *Biriyani*, sold in the road side restaurants of India at a rate of Rs. 50 per packet, lower than the cost of approximately 100 grams of mutton/chevon used in it! As per some report - cheap toxic colorants used during color festival *Holi* are detected by some Indian researchers in some famous sweet items in India (Pattanayak 2014). Many deep fried items are famous everywhere in India. Checking of the quality, source, sale and transportation of that black colored oil (in the name of Palm oil) is perhaps beyond the control of any agency (Fig. 1.).

Questions for safe certificate from the Indian point of view

From the point of view of an Indian, the contemporary toxicity study of food additives, listing of the safe food additives and overall consideration of prepared processed foods as 'safe' have the following limitations.

Table 1. Use of different chemicals as food additives.

Ingredient	Action	Example of use	Names found on product level
Preservatives	Prevent food spoilage from bacteria, molds, fungi, or yeast (antimicrobials); slow or prevent changes in color, flavor, or texture and delay rancidity (antioxidants); maintain freshness	Fruit sauces and jellies, beverages, baked goods, cured meats, oils and margarines, cereals, dressings, snack foods, fruits and vegetables	Ascorbic acid, citric acid, sodium benzoate, calcium propionate, sodium erythorbate, sodium nitrite, calcium sorbate, potassium sorbate, BHA, BHT, EDTA, tocopherols (Vitamin E)
Sweeteners	Add sweetness with or without the extra calories	Beverages, baked goods, confections, table-top sugar, substitutes, many processed foods	Sucrose (sugar), glucose, fructose, sorbitol, mannitol, corn syrup, high fructose corn syrup, saccharin, aspartame, sucralose, acesulfame potassium (acesulfame-K), neotame
Color Additives	Offset color loss due to exposure to light, air, temperature extremes, moisture and storage conditions; correct natural variations in color; enhance colors that occur naturally; provide color to colorless and "fun" foods.	Many processed foods, (candies, snack foods, margarine, cheese, soft drinks, jams/jellies, gelatins, pudding and pie fillings)	FD&C Blue Nos. 1 and 2, FD&C Green No. 3, FD&C Red Nos. 3 and 40, FD & C Yellow No. 5 (tartrazine) and No. 6, Orange B, Citrus Red No. 2, annatto extract, beta-carotene, grape skin extract, cochineal extract or carmine, paprika oleoresin, caramel color, fruit and vegetable juices, saffron (Note: Exempt color additives are not required to be declared by name on labels but may be declared simply as colorings or color added)
Flavors and Spices	Add specific flavors	Pudding and pie fillings, gelatin dessert mixes, cake mixes, salad dressings, candies, soft drinks, ice cream, BBQ sauce	Natural flavoring, artificial flavor, and spices
Flavor Enhancers	Enhance flavors already present in foods (without providing their own separate flavor)	Many processed foods	Monosodium glutamate (MSG), hydrolyzed soy protein, autolyzed yeast extract, disodium guanylate or inosinate
Fat Replacers (components used to replace fats)	Provide expected texture and a creamy "mouth-feel" in reduced-fat foods	Baked goods, dressings, frozen desserts, confections, cake and dessert mixes, dairy products	Olestra, cellulose gel, carrageenan, polydextrose, modified food starch, micro particulated egg white protein, guar gum, xanthan gum, whey protein concentrate
Nutrients	Replace vitamins and minerals lost in processing (enrichment), add nutrients that may be lacking in the diet (fortification)	Flour, breads, cereals, rice, macaroni, margarine, salt, milk, fruit beverages, energy bars, instant breakfast drinks	Thiamine hydrochloride, riboflavin (Vitamin B2), niacin, niacinamide, folate or folic acid, beta carotene, potassium iodide, iron or ferrous sulfate, alpha tocopherols, ascorbic acid, Vitamin D, amino acids (L-tryptophan, L-lysine, L-leucine, L-methionine)
Emulsifiers	Allow smooth mixing of ingredients, prevent separation, keep emulsified products stable, reduce stickiness, control crystallization, keep ingredients dispersed, and to help products dissolve more easily	Salad dressings, peanut butter, chocolate, margarine, frozen desserts	Soy lecithin, mono- and diglycerides, egg yolks, polysorbates, sorbitan monostearate

(Contd.)

Table 1. Use of different chemicals as food additives (Contd.)

Ingredient	Action	Example of use	Names found on product level
Stabilizers, Thickeners, Binders, Texturizers	Produce uniform texture, improve "mouth-feel"	Frozen desserts, dairy products, cakes, pudding and gelatin mixes, dressings, jams and jellies, sauces	Gelatin, pectin, guar gum, carrageenan, xanthan gum, whey
Leavening Agents	Promote rising of baked goods	Breads and other baked goods	Baking soda, monocalcium phosphate, calcium carbonate
Anti-caking agents	Keep powdered foods free-flowing, prevent moisture absorption	Salt, baking powder, confectioner's sugar	Calcium silicate, iron ammonium citrate, silicon dioxide
Humectants	Retain moisture	Shredded coconut, marshmallows, soft candies, confections	Glycerin, sorbitol
Yeast Nutrients	Promote growth of yeast	Breads and other baked goods	Calcium sulfate, ammonium phosphate
Dough Strengtheners and Conditioners	Produce more stable dough	Breads and other baked goods	Ammonium sulfate, azodicarbonamide, L-cysteine
Firming Agents	Maintain crispness and firmness	Processed fruits and vegetables*	Calcium chloride, calcium lactate
Enzyme Preparations	Modify proteins, polysaccharides and fats	Cheese, dairy products, meat	Enzymes, lactase, papain, rennet, chymosin
Gases	Serve as propellant, aerate, or create carbonation	Oil cooking spray, whipped cream, carbonated beverages	Carbon dioxide, nitrous oxide

*Many other chemicals like waxes are used on fruits like apple in India for such purpose.

1. It does not include all the chemicals used with processed foods in the developing countries like India.

The primary food item themselves contains many food additives, preservatives and adulterants.

These are not listed, so their effects are not analyzed. Following examples may enlighten the subject.

a) Milk – a primary food item - may be adulterated with Formaldehyde, Urea, hydrogen peroxide. Ammonium sulfate, Nitrate, Benzoic acid, Salicylic acid, Borax, Boric acid, detergent, pulverised soap, coloring matter etc. (Azad and Ahmed 2016). The synthetic milk made from detergent powder is also reported. In a nationwide survey performed on 2015 by the Food safety and Standards Authority of India (FSSAI), 68.4% of milk samples were below the prescribed standards and 5.75% were adulterated with detergents (Bagla 2016). In another sample study performed in Hyderabad (India), Urea, Formaldehyde, detergent and hydrogen peroxide were found in 60%, 32%, 44% and 32% of milk (Singuluri and Sukumaran 2014). The sweets and other milk based preparations like *paneer* (cheese), *dahee* (yogurt), tea etc. are made from such milk.

b) Many of the fruits are sprayed with many pesticides, antimicrobials, antifungal, waxes etc. to protect them from spoilage.

c) Many toxic chemicals are used directly as spray or injection for ripening of fruits (as banana, mango etc.) and also vegetables (as tomato).

These primary items are used in preparation of processed foods.

2. Lack of control on the use of chemicals during preparation of food and food products

Many rules are made to control the use of toxic chemicals in food. But these are having very limited benefit to the people as the manufacturers are not kept

Table 2. Toxic food ingredients and artificial additives.

Sl.No.	Additives	Use	Toxicity
A. Preservative, stabilizer, sweetener etc.			
1.	Sodium nitrate	Added to processed meats to stop bacterial growth	Linked to cancer in humans - Worst Offender
2.	Sulfites	Used to keep prepared foods fresh	Can cause breathing difficulties in those sensitive to the ingredient
3.	Azodicarbonamide	Used in bagels and buns	Can cause asthma
4.	Potassium bromate	Added to breads to increase volume	Linked to cancer in humans
5.	Propyl gallate	Added to fat-containing products	Linked to cancer in humans
6.	BHA/BHT	A fat preservative, used in foods to extend shelf life	Linked to cancerous tumour growth
7.	Propylene glycol	Better known as antifreeze. Thickens dairy products and salad dressing. Deemed generally' safe by FDA	Toxicity includes central nervous system (CNS) toxicity, hyperosmolarity, hemolytic, cardiac arrhythmia, seizures, agitation, and lactic acidosis (Lim *et al.* 2014)*
8.	Butane	Put in chicken nuggets to keep them tasting fresh	A known carcinogen
9.	Monosodium glutamate (MSG)	Flavour enhancer	That can cause headaches. Linked in animal studies to nerve damage, heart problems and seizures
10.	Disodium inosinate	In snack foods	Contains MSG
11.	Disodium guanylate	Used in snack foods	Contains MSG
12.	Enriched flour	Used in many snack foods - a refined starch	It is made from toxic ingredients
13.	Recombinant Bovine Growth Hormone (rBGH)	Genetically-engineered version of natural growth Hormone in cows. Boosts milk production in cows	Contains high levels of IGF-1, which is thought to cause various types of cancer
14.	Refined vegetable oil	Includes soybean oil, corn oil, safflower oil, canola oil, and peanut oil	High in omega - 6 fats, which are thought to cause heart disease and cancer**
15.	Sodium benzoate	Used as a preservative in salad dressing and carbonated beverages	A known carcinogen and may cause damage our DNA
16.	Brominated vegetable oil	Keeps flavour oils in soft drinks suspended	Bromate is a poison and can cause organ damage and birth defects. Not required to be listed on food labels
17.	Propyl gallate	Found in meats, popcorn, soup mixes and frozen dinners	Shown to cause cancer in rats. Banned in some countries. Deemed safe by FDA
18.	Olestra	Fat-like substance that is unabsorbed by the body. Used in place of natural fats in some snack foods	Can cause digestive problems, and also not healthy for the heart
19.	Carrageenan	Stabilizer and thickening agent used in many prepared foods	Can cause ulcers and cancer
20.	Polysorbate 60	A thickener that is used in baked goods	Can cause cancer in laboratory animals
21.	Camauba wax	Used in chewing gums and to glaze certain foods	Can cause cancer and tumours
22.	Magnesium sulphate	Used in tofu (coagulated Soybean milk).	Can cause cancer in laboratory animals
23.	Chlorine dioxide	Used in bleaching flour	Can cause tumours and hyperactivity in children
24.	Paraben	Used to stop mold and yeast forming in foods	Can disrupt hormones in the body, and could be linked to breast cancer
25.	Sodium carboxymethyl cellulose	Used as a thickener in salad dressings	Could cause cancer in high quantities
26.	Aluminum	A preservative in some packaged foods	Can cause cancer***
27.	Saccharin	Artificial sweetener	Carcinogen found to cause bladder cancer in rats. Worst offender
28.	Aspartame	Artificial sweetener	An excitotoxin and thought to be a carcinogen. Can cause dizziness, headaches, blurred vision and stomach problems

(Contd.)

Table 2. Toxic food ingredients and artificial additives (Contd).

Sl.No. Additives	Use	Toxicity
29. High fructose corn syrup	Artificial sweetener made from corn starch. Made from genetically-modified corn	Causes obesity, diabetes, heart problems, arthritis and insulin resistance
30. Acesulfame potassium	Artificial sweetener used with other artificial sweeteners in diet, sodas and ice cream	Linked to lung and breast tumours in rats
31. Sucralose	Artificial sweetener	Can cause swelling of liver and kidneys and a shrinkage of the thymus gland
32. Agave nectar	Artificial sweeteners derived from a cactus	Contains high levels of fructose, which causes insulin resistance, liver disease and inflammation of body tissues
33. Bleached starch	Artificial sweetener used in many dairy products	Thought to be related to Asthma and skin irritations
34. Tert butylhydroquinone	Artificial sweetener used to preserve fish products	Could cause stomach tumours at high doses
B, Artificial colour		
35.Red #40	Found in many foods to alter colour. All modern food dyes are derived from petroleum	A carcinogen that is linked to cancer in some studies. Also can cause hyperactivity in children. Banned in some European countries. Worst Offender
36. Blue #1	Used in bakery products, candy and soft drinks	Can damage chromosomes and lead to cancer
37. Blue #2	Used in candy and pet food beverages	Can cause brain tumours
38. Citrus red #1	Sprayed on oranges to make them look ripe	Can damage chromosomes and lead to cancer
39. Citrus red #2	Used to colour oranges	Can cause cancer if the peel is eaten
40. Green #3	Used in candy and beverages	May cause bladder tumours
41. Yellow #5	Used in desserts, candy and baked goods	Thought to cause kidney tumours, according to some studies
42. Yellow #6	A carcinogen used in sausage, beverages and baked goods	Thought to cause kidney tumours, according to some studies
43. Red #2	A food colouring	May cause both asthma and cancer
44. Red #3	It is added to cherry pie filling, ice cream and baked goods	A carcinogen, can also cause nerve damage and thyroid cancer
45. Caramel	In soft drinks, sauces, pastries and breads	When made with ammonia, it can cause Cancer in mice. Food companies not required to disclose if this ingredient is made with ammonia
46. Brown HT	Used in many packaged foods	Can cause hyperactivity in children, asthma and cancer
47. Orange B	A food dye that is used in hot dog and sausage casings	High doses are bad for the liver and bile duct
48. Bixin	Used for food colouring	It can cause hyperactivity in children and asthma
49. Norbixin	Used for food colouring	It can cause hyperactivity in children and asthma
50. Annatto	Used for food colouring	It can cause hyperactivity in children and asthma

* Also used in cold drinks. But in many cold drinks, Ethylene glycol is used in it's place, which is toxic like Arsenic (Antor 2016).
** Scientists found that heating up vegetable oils led to the release of high concentrations of chemicals called aldehydes, which have been linked to illnesses including cancer, heart disease and dementia (The Telegraph 2015).
***Also used as thin cover on some sweets instead of silver and so eaten with sweets (Times of India 2015).

under strict vigilance to follow the rules.

In India, anybody can prepare any food or food product and can sell them anywhere without having any basic idea about such food preparation, the toxicity of the chemicals used in it, effect of personal hygiene of the food handlers on food, contamination of micro organisms in openly kept food or food products and storage procedures of the prepared food.

3. Lack of consciousness of the consumers

The consciousness of common people of India (the customers) is at such a level that almost everybody

are ready to consume anything sold at the name of food, without even thinking about the quality of the food or it's items! They are not ready to even think about the hygiene of the food, food producer or the seller who sells directly the food products at open roadside stalls. They just want cheap food suppressing all the queries about the level of adulteration, quality, possible toxicity etc. inside their mind.

Requirement for study of cumulative effects of all the residual and added chemicals

The allopathic medicines, pesticide residues in the food items, the adulterants and added chemicals in the name of artificial color, flavor, stabilizing agent, emulsifying agent, chilling agent etc. as well as the toxic chemicals enter through different ways inside the body system of modern men as a part of modern lifestyle are definitely acting together during causing any effect. The same detoxifying organs and excretory organs inside our body are struggling to clear them. Without considering that point how the studies performed to determine the toxic effect of any added chemical agent can be said as complete and practical?

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